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(54) **SYSTEM AND METHOD FOR PROCESSING AN UNDERWATER ACOUSTIC SIGNAL BY IDENTIFYING NONLINEARITY IN THE UNDERWATER ACOUSTIC SIGNAL**

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(57) **ABSTRACT**

A nonlinear signal processing system and method is used to identify nonlinearity (e.g., chaos) in underwater acoustic signals, such as sonar signals. The system and method detects the underwater acoustic signal and digitizes the underwater acoustic signal to produce an acoustic time series. The acoustic time series is reconstructed using a phase space embedding algorithm to generate a phase space embedded acoustic signal. A differential radius signal is generated from the phase space embedded acoustic signal using chaotic radius computations and differential radius computations. Thresholds can be detected in the differential radius signal to reveal nonlinear or chaotic events hidden in the underwater acoustic signal.

19 Claims, 10 Drawing Sheets